

REMARKS/ARGUMENT

Claim 1 has been amended to require the cation-exchange resin catalyst to be swollen with solvent and to be packed in a reaction portion of the catalytic distillation apparatus.

Support for this amendment exists throughout the present application, including page 9, lines 16-17 and page 10, lines 6-8.

Claims 6-8 have been canceled.

Claims 1-5 are currently pending.

The Office Action rejected the pending claims under 35 U.S.C. § 103 as obvious over Okumura in view of Smith, and as obvious over Okumura in view of Matsuzawa and Smith. In view of the following comments, Applicants respectfully request reconsideration and withdrawal of these rejections.

The present invention relates to producing a tert butyl alcohol from a C₄ hydrocarbon mixture containing a low level of isobutylene using a cation-exchange resin catalyst swollen with solvent and packed in a reaction portion of the catalytic distillation apparatus. This reaction occurs in a gas-liquid mixed phase. (See, specification at page 10, lines 6-8). The art upon which the Office Action has relied neither teaches nor suggests that useful methods of producing a tert butyl alcohol could be practiced using such low levels of isobutylene and/or the required swollen catalyst in a gas-liquid mixed phase reaction.

More specifically, Okumura relates to more conventional methods in which C₄ hydrocarbon mixtures containing a high level of isobutylene, such as those obtained through steam or catalytic cracking of petroleum, are used. (See, col. 2, lines 24-26). Furthermore, Okumura discloses a liquid phase reaction in a fixed bed (the reaction occurs while the catalyst is in solution). (See, col. 4, lines 1-3; col. 5, lines 59-66; Examples 1-6). Nothing in Okumura would lead one skilled in the art to use a C₄ hydrocarbon mixture containing a low

level of isobutylene, particularly in view of the concentration dilution which occurs when solvent is added. Furthermore, given that Okumura discloses a liquid phase reaction, nothing in Okumura would lead one skilled in the art to use a cation-exchange resin catalyst swollen with solvent and packed in a reaction portion of the catalytic distillation apparatus to effect a gas-liquid mixed phase reaction. That is, nothing in Okumura would lead one skilled in the art to believe that sufficient reaction speed could be obtained using a C₄ hydrocarbon mixture containing a low level of isobutylene, particularly in view of the subsequent concentration dilution which occurs when solvent is added, to yield a useful process, or that a swollen catalyst could be used in a different type of reaction (gas-liquid mixed phase reaction) to yield a useful process.

Similarly, Matsuzawa discloses a liquid phase reaction (the reaction occurs while the catalyst is in solution). (See, col. 6, lines 19-34; Examples 1-2). Thus, similarly, given that Matsuzawa discloses a liquid phase reaction, nothing in Matsuzawa would lead one skilled in the art to use a cation-exchange resin catalyst swollen with solvent and packed in the reaction portion of the catalytic distillation apparatus to effect a gas-liquid mixed phase reaction. That is, nothing in Matsuzawa would lead one skilled in the art to believe that a swollen catalyst could be used in a different type of reaction (gas-liquid mixed phase reaction) to yield a useful process.

Nothing in Smith compensates for these critical deficiencies. Smith merely relates to a distillation apparatus, and neither teaches nor suggests using a C₄ hydrocarbon mixture containing a low level of isobutylene. Moreover, Smith does not teach or suggest using a cation-exchange resin catalyst swollen with solvent and packed in the reaction portion of the catalytic distillation apparatus in a gas-liquid mixed phase reaction.

Thus, neither Okumura, Matsuzawa, nor Smith, alone or in combination, teaches or suggests the claimed invention.

Finally, the Office Action asserted that “the [claimed] reaction is specific to isobutylene in the mixture and it is independent of the content of isobutylene in the mixture.” (Office Action at pages 2-3). Applicants note, however, that one skilled in the art would expect the reaction speed of an ordinary fixed bed reaction such as those in Okumura and Matsuzawa to be extremely low due to dilution resulting from addition of any solvent. Such a dilution effect is a serious issue with respect to developing an economic, commercial process. In stark contrast, the invention methods address such issues, using a swollen catalyst and performed in a gas-liquid mixed phase to improve reaction speed. None of the art upon which the Office Action has relied teaches or suggests such methods or any resulting benefits from such methods.

In view of the above, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. § 103.

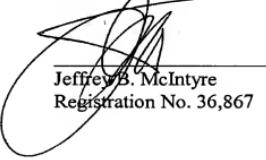
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Applicants believe that the present application is in condition for allowance. Prompt and favorable consideration is earnestly solicited.

Respectfully submitted,

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